PRELIMINARY FIELD REPORT

GEOPHYSICAL INVESTIGATION AT FORT ELLSWORTH

KANOPOLIS LAKE, ELLSWORTH COUNTY, KANSAS

by

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Report Prepared for
the U.S Army Corps of Engineer District - Kansas City

Military Interdepartmental Purchase Request KC 96-66

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National Park Service
U.S. Department of the Interior
Denver, Colorado

1996

INTRODUCTION

Between March 25 and 29, the National Park Service conducted geophysical investigations at Fort Ellsworth, a nineteenth century military post located adjacent to the Smoky Hill River within the boundary of the U.S. Army Corps of Engineers' (COE) Kanopolis Lake, Ellsworth County, Kansas. The investigations were conducted in order to provide subsurface information concerning the site for proposed summer excavations.

GEOPHYSCIAL SURVEY METHODS

Magnetic and resistance surveys were conducted. Utilizing the COE datum at N500/E500 (the datum was established in feet and the base line oriented true North - an earlier baseline was established 20 degrees west of true North and had rebar set at 50 ft intervals), a series of 20 x 20 m grids were established. The geophysical grid was oriented towards magnetic north with is approximately 8 degrees east of true North (Figure 1). The geophysical grid extends 40 meters on both sides of the north-south grid base line and 60 m on both sides of the east-west grid base line. The grid measures 120 m north-south by 80m east-west (for data processing purposes, the grid was extended another 40 m to the west). The magnetic survey covered sixteen complete grids and three partial grids. The resistance survey covered fourteen complete and three partial grids.

MAGNETIC SURVEY

A magnetic survey is a passive geophysical technique used to measure the earth's total magnetic field a point location. Its application to archeology results from the effects of magnetic materials on the earth's magnetic. These anomalous conditions result from magnetic materials and minerals buried in the soil. Iron artifacts have a very strong effect on the local earth's magnetic field. Other cultural features which affect the local earth's magnetic field include fire hearths, soil disturbances, such as pits, mounds, wells, pithouses, dugouts, etc., and geological features.

The magnetic survey was conducted with a Geoscan Research FM36 Fluxgate Gradiometer. The gradiometer consists of a control unit which contains the electronics and memory. The control unit is attached to the vertical sensor tube which contains two fluxgate magnetometer sensors. With a built-in data logger, the gradiometer provides fast and efficient surveying. Two readings are taken at each point along a survey traverse, one at the upper sensor and one at the lower sensor. The difference or gradient between the two is calculated and recorded in the instrument's memory. For the magnetic survey, the gradiometer was configured to record data at a sampling interval of 0.125 m or 8 samples per meter. The survey was conducted along one meter transverses in a zig-zag fashion across the grid beginning in the southwest corner. The data was downloaded to a laptop computer in the

field and processed using the Geoscan Research Geoplot ver. 2.01 software. Shade, dot density, and trace plots were generated each evening as the field work progressed. Contour plots were generated in Surfer for Windows.

Analysis of the gradiometer data from the site indicated the presence of 14 anomalies (Figure 2 and 3). At the southern end of the grid adjacent to Dugout #13, Anomaly 1, a number of non-normal dipoles, appears to represent an area of metal artifacts discarded along the outside wall of the dugout. A normal dipole anomaly is one which is oriented with its high value on the south side and its negative value on the north side similar to the way the magnetic field of the earth behaves or a permanent magnet. Non-normal dipoles generally represent iron artifacts or disturbed soil or excavated fill. Anomaly 2, located along the southeast corner of the grid, also appears to represent a collection of discarded metal. Anomaly 3 is a normal dipole and is located in the vicinity of Dugout #12. The anomaly may represent a fire hearth. This is an area containing a concentration of rocks. Anomaly 4 consists of several non-normal dipoles and apparently represents iron artifacts in and around Dugout #10. To the south of the anomaly lies Dugout #11 and to the north lies Dugout #8. Anomaly 5 may also represent iron artifacts associated with Dugout #7 or the location of the subsurface excavation cut to form the dugout wall. Anomaly 6 is located along the ridge top immediately east of Dugout #7. It apparently represents a small piece or concentration of iron artifacts. Anomaly 7 is a series of non-normal dipoles associated with Dugout 6. It would appear that this anomaly represents a discard area adjacent to the dugout. Anomaly 8 represents the rebar used as the COE datum on the site at N500/E500. To the east of Animal 8 is an anomalous area that may be one of the previous excavation units on the site. Anomaly 9 is a relatively strong normal dipole located within Dugout #3. The anomaly may represent a fire hearth or an iron artifact. Anomaly 10 is a series of non-normal dipoles on the north side of a field road through the site. It probably represents a collection of iron artifacts dumped in this area. Anomalies 11 and 13 are adjacent to Dugout #2 and the field road. They may be iron artifacts associated with Dugout #2 or they may represent the excavated portion of the field road as it cuts through the side slope. Anomaly 12 is caused by the barbed wire fence at the north end of the geophysical grid. The barbed wire and steel fence posts have a major effect on the magnetic field in this location. Anomaly 14 is a non-normal dipole which is probably an iron artifact or concentration of iron in a single location.

RESISTANCE SURVEY

A resistance survey was also conducted at the site. The resistance survey was conducted with a Geoscan Research RM 15 resistance meter and PA5 multi-probe array. The instrument consists of the control unit mounted on the PA5 mobile probe frame. The instrument is also connected to two remote probes by

a fifty meter cable. The probes are configured as a twin probe array with one current and one voltage probe located on the PA5 frame and the second set of current and voltage probes located at the end of the cable. The meter was set to take data at 0.5 meter intervals along one meter transverses. The survey was conducted in a zig-zag fashion beginning in the southwest corner of each grid. The distance between the two mobile probe on the frame provide a rough estimated of the depth from which the data is collected. That is the probe setting of 0.5 m provides for approximately 0.5 m depth penetration. The resistance survey encountered several problems including the compact nature of the soil in several locations and the extreme cold weather on the last day. The cold weather apparently affected the nature of the data collected from six grids on the last day of field work. The temperature was below 40 degrees F with a wind chill of 19 to 20 degrees F. The poor data was especially noticeable in the grid which had the COE datum as the southwest corner.

The soils within the project area consist of the Jansen sandy loam, 1 to 4 percent slopes and the Wells loam. 1 to 3 percent slopes. The Jansen sandy loam is deep, gently sloping, and well drained. It occurs on the ridgetops and side slopes in upland settings. This soil was formed in loamy sediments over alluvial sand and gravel. This soil mapping unit covers the majority of the site especially the area of the dugouts along the side slope facing the Smoky Hill River. The Wells loam occurs in the northeastern corner of the site. This soil is deep, gently sloping, and well drained. It occurs on side slopes in the uplands. It was formed in material weathered from sandstone and in old alluvium derived from sandstone and sandy shale.

On the ridgetop and the eastern side slope, the resistance values are much higher than the majority of the dugout locations along the western slope facing the river (Figures 4 and 5). The high resistance values are indicative of the sandy type soils. The previously excavated trench and test units on the ridgetop have extremely higher resistance values due to the use of plastic to line the backfilled units. The plastic acts as an insulator. The dugouts, especially those under the tree canopy have much lower values (in the range of 60 to 120 ohms) due to the litter cover and decomposing organic matter. This has allowed for more soil moisture and better conductivity. On the south side of Dugout #13 there is an area of higher resistive values. This are may represent wall cut or wall materials. The magnetic data from the same location also indicated a change which may have resulted for the construction of the dugout or it may be associated with a geological feature associated with the formation of the landform. The rock feature between Dugout #13 and 12 is visible in the resistance data. The area of Dugout #11 has a similar resistance anomaly to the rock feature in Dugout #12. In the area of Dugouts #2 through 7, The resistance values within the dugout locations is slightly less that the values for the unexcavated ridgetop. Dugouts #6, 5, 4, and 3 appear to be well defined with lesser values than the surrounding ridgetop. The area identified

as Dugout #2 appears to have higher resistive values. The farm field road along the northern portion of the site is present on both Geoplot maps (Figures 2 and 4).

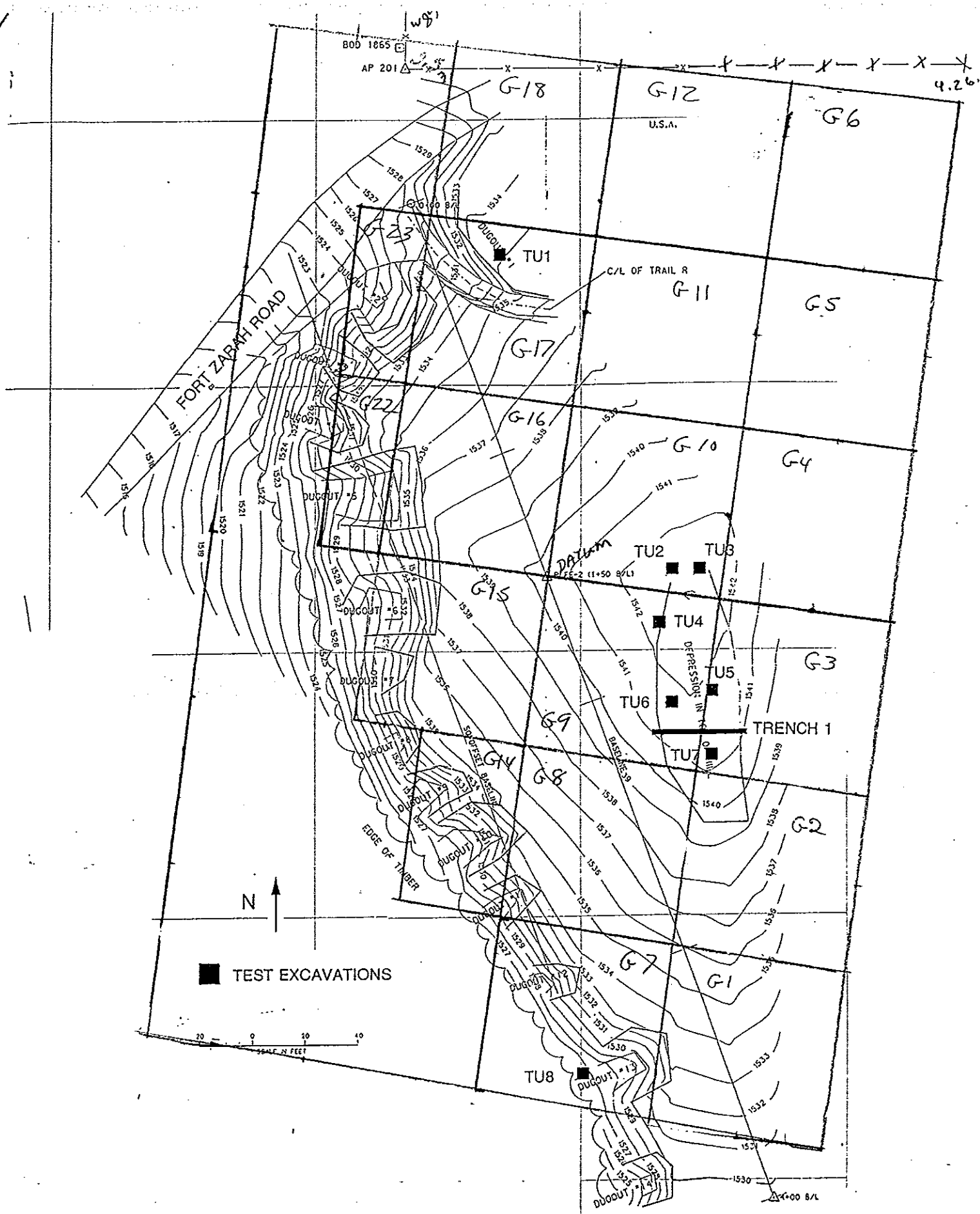

FIGURE 4. Locality 14EW26-VI investigated in 1995.

Figure 1. Geophysical Grids at 14EW26-VI.

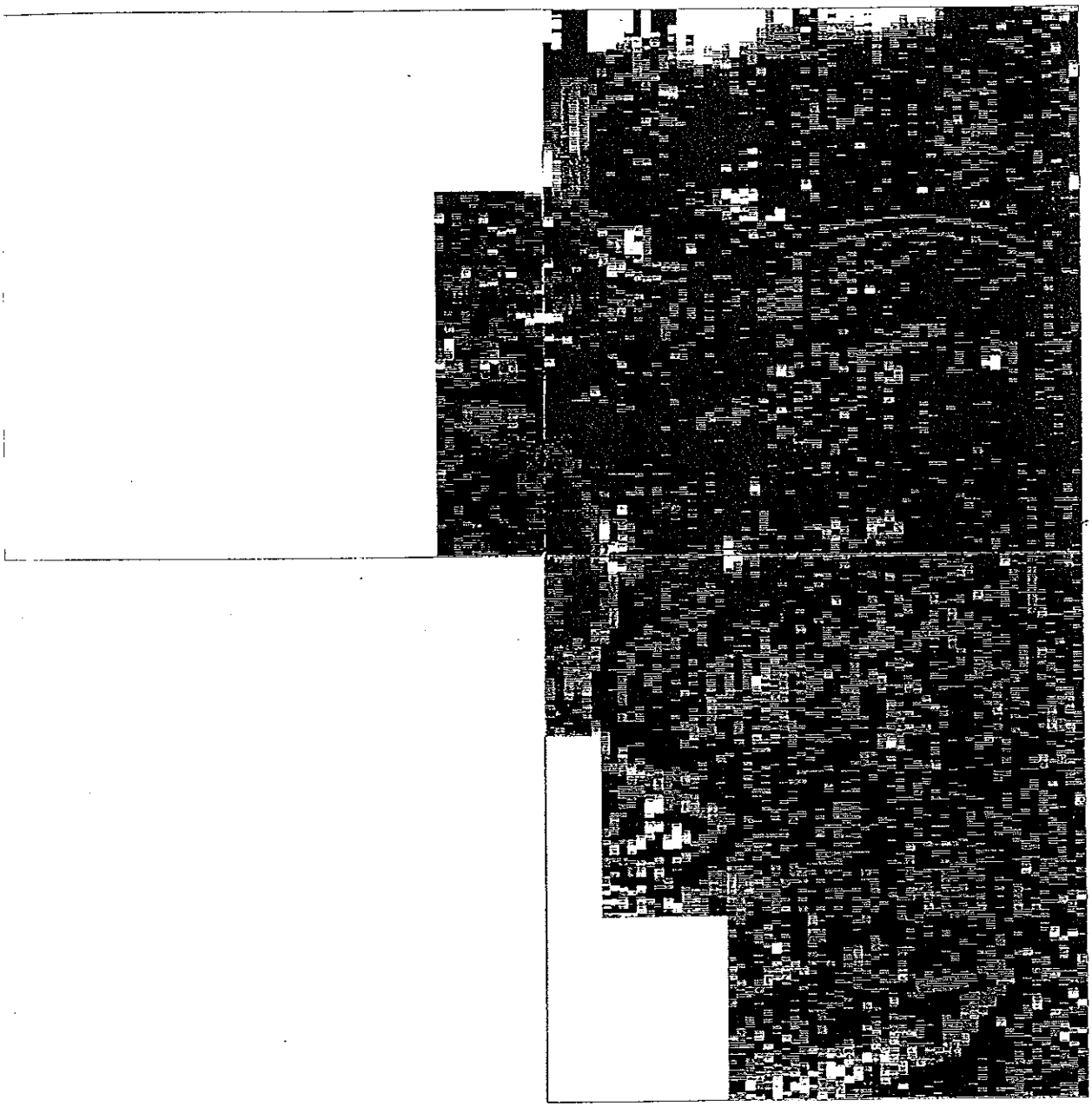

Figure 2. Geoplot shade plot of magnetic data.

FORT ELLSWORTH ARCHEOLOGICAL SITE (14EW26-VI)
KANOPOLIS LAKE, ELLSWORTH COUNTY, KANSAS

Magnetic Survey, 25-29 March 1996
Data Contour Interval = 0.5 nT

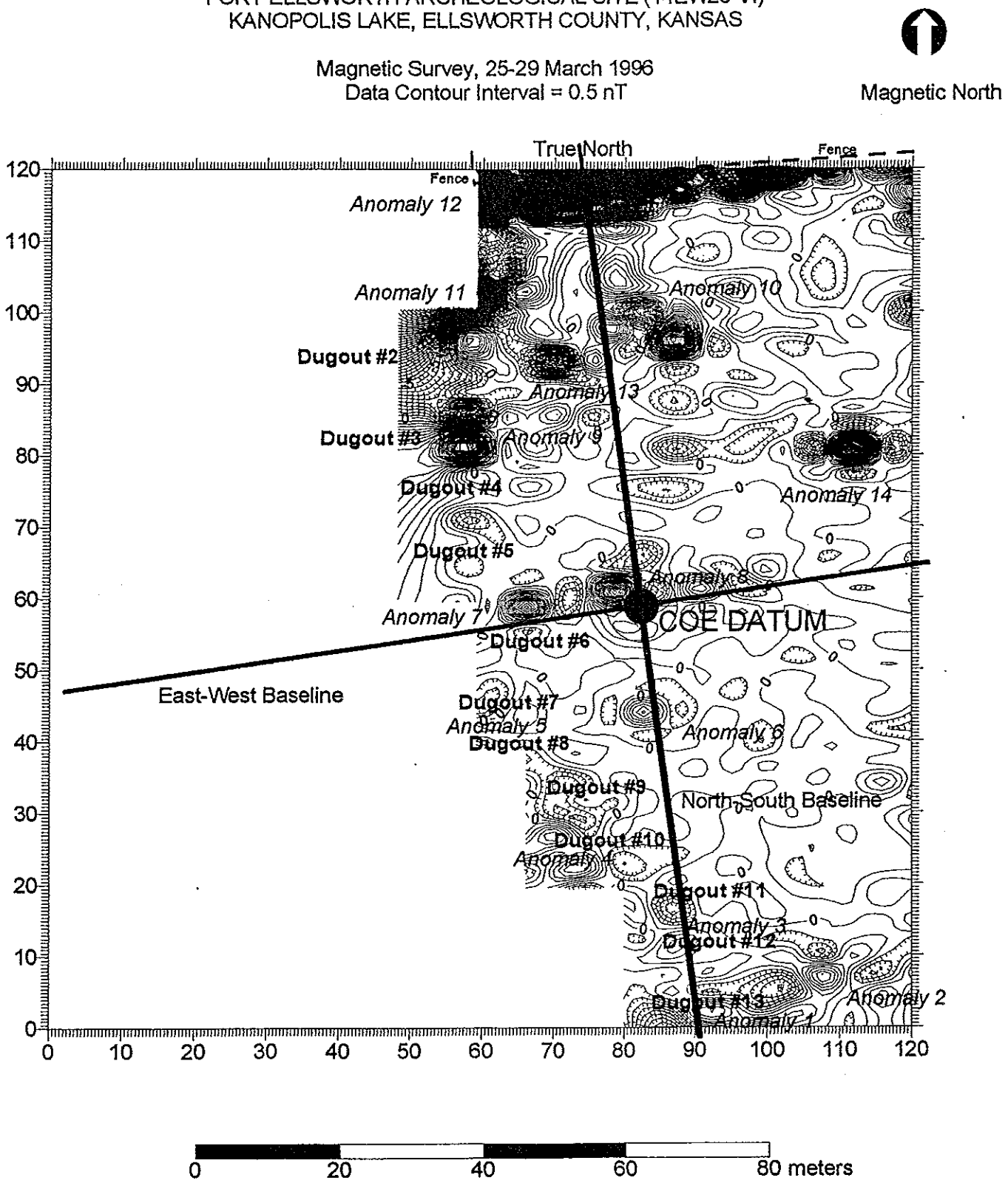

Figure 3. Contour plot of magnetic data.

Site : ells Comp. : elrla		Resist. Survey		Scale	1:738
Shade Plot (Clip)		Size x 0.5		Block	Off
Minimum Maximum Contrast Units	-1 1 1 Std.Dev.	Grey Levels Palette	17 Negative	Black White	

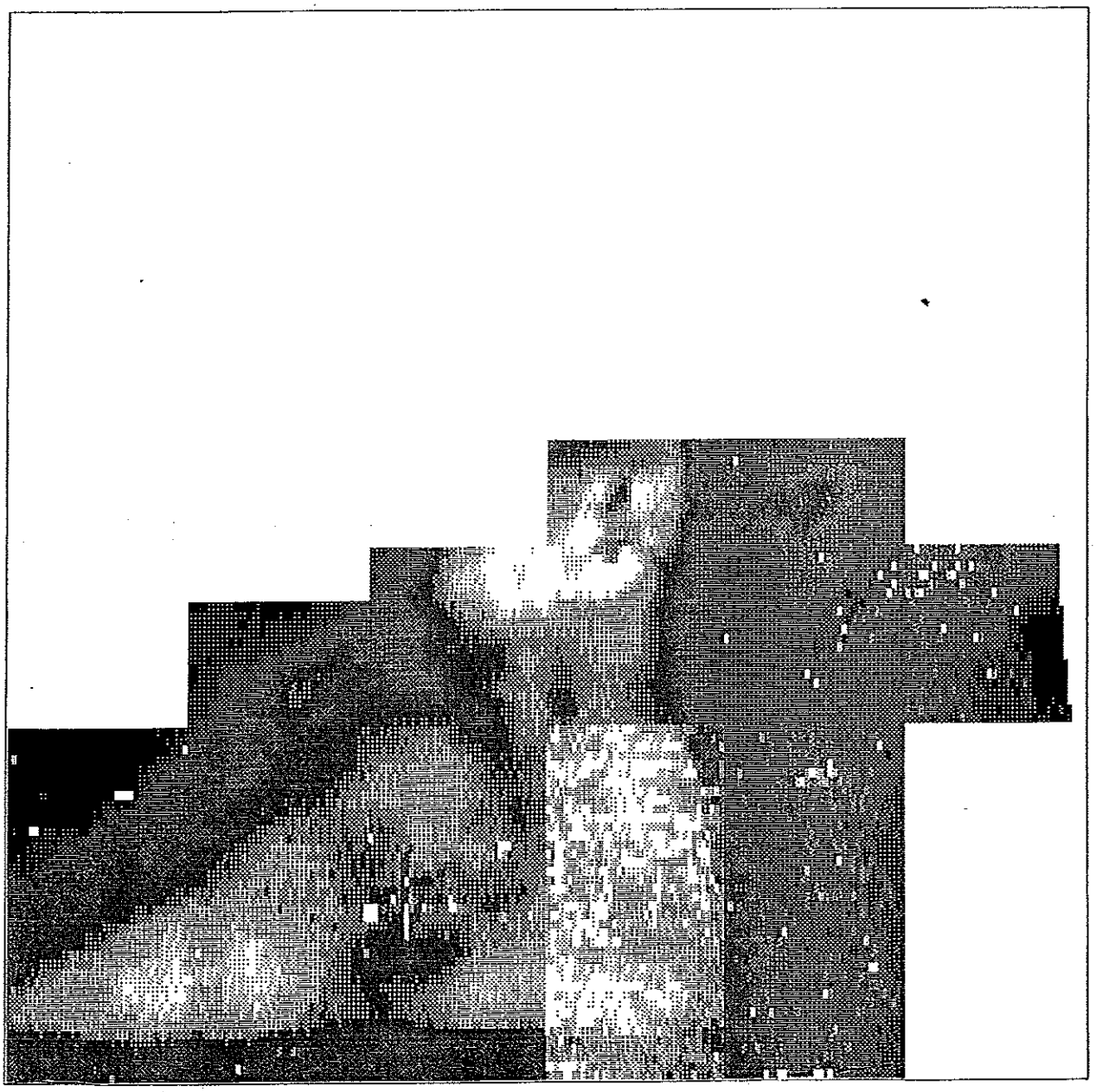

Figure 4. Geoplot shade plot of resistance data.

FORT ELLSWORTH ARCHEOLOGICAL SITE (14EW26-VI)
KANOPOLIS LAKE, ELLSWORTH COUNTY, KANSAS

Resistance Survey, 25-29 March 1996
Data Contour Interval = 5 ohms

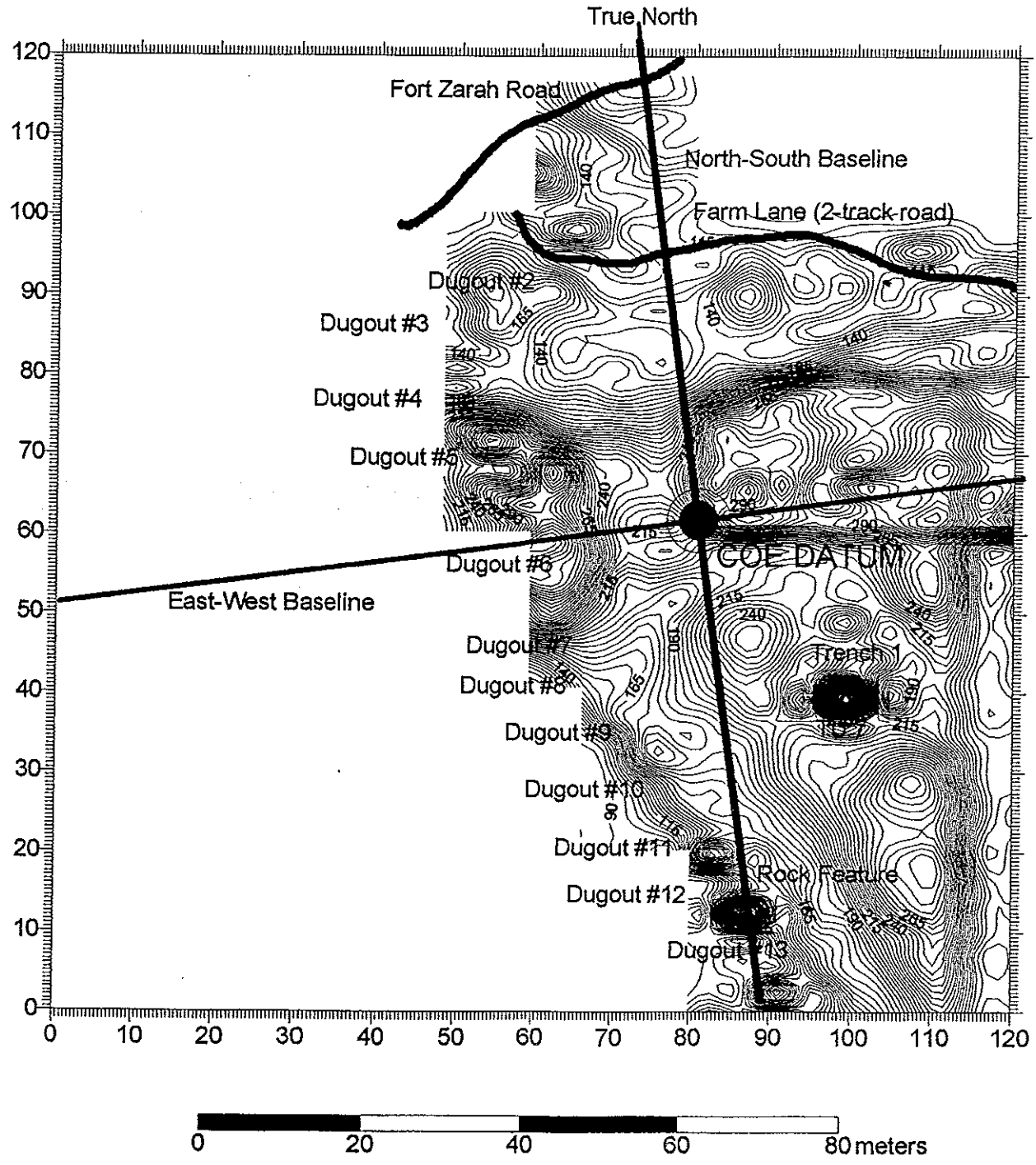

Figure 5. Contour plot of resistance data.